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VALIDATION OF *SELAGINELLA PSITTACORRHYNCHA* (SELAGINELLACEAE), A NEW SPECIES FROM THE GUIANA HIGHLANDS OF VENEZUELA AND BRAZIL

IVÁN A. VALDESPINO
Departamento de Botánica
Facultad de Ciencias Naturales, Exactas y Tecnología
Universidad de Panamá
Apartado Postal 0824-00073, Panamá
iavaldespino@gmail.com

ABSTRACT

Selaginella psittacorrhyncha Valdespino is validated as a new species from the Guiana Highlands of Venezuela and Brazil by providing a description, illustrations, and discussion on taxonomic affinity, as well as information on conservation status. Its centipede-like habit, ascending to erect stems with anisotomously branching pattern, and strobili born almost laterally on the main stems resemble that of the Panamanian *S. taylorii* Valdespino and *S. chrysoleuca* Spring and *S. euclimax* Alston ex Crabbe & Jermy, both found also in Panama and western South America. *Selaginella psittacorrhyncha* differs from them by its lateral rhizophores, coriaceous leaves, acute and parrot's beak-like median leaf apices, and orange megaspores. *Selaginella psittacorrhyncha* is morphologically closer to *S. vernicosa* Baker of Venezuela and Brazil, from which it is set aside by its ascending to suberect stems, ascending branches, coriaceous leaves, median leaves with the outer bases glabrous or infrequently puberulent only with 1 or 2 short hairs and parrot's beak-like apices.

RESUMEN

Selaginella psittacorrhyncha Valdespino es validada como una especie nueva del Escudo guayanés de Venezuela y Brasil mediante una descripción, ilustraciones y discusión de sus afinidades taxonómicas, así como información sobre su estado de conservación. Su hábito centipediforme, tallos ascendentes a suberectos con un patrón de ramificación anisótomo y estróbilos que se originan casi lateralmente en el tallo principal la asemejan a *S. taylorii* Valdespino de Panamá y a *S. chrysoleuca* Spring y *S. euclimax* Alston ex Crabbe & Jermy, las cuales se encuentran también en dicho país y en el Oeste de Sudamérica. *Selaginella psittacorrhyncha* se diferencia de dichas especies por sus rizóforos laterales, hojas coriáceas y hojas mediales con los ápices agudos, parecidos al pico de un loro y megasporas anaranjadas. *Selaginella psittacorrhyncha* es mucho más cercana morfológicamente a *S. vernicosa* Baker de Venezuela y Brasil, de la que se distingue por sus tallos ascendentes a suberectos, ramas ascendentes y hojas coriáceas, las mediales con los ápices parecidos al pico de un loro.

Selaginella psittacorrhyncha Valdespino was first noticed as an undescribed taxon from the Guiana Highlands in Venezuela and Brazil and included in my previous paper describing some new species from the latter country (Valdespino 2015) as "*S.* sp. A.," with the intended specific epithet "*psittacorrhyncha*." At that time, however, the species could not be formally described because additional studies, including Scanning Electron Microscopy (SEM) of leaves and spores to ascertain morphological features as per Valdespino (2015, 2016, 2017) were underway. Now that such studies are concluded, allowing for a better understanding and documentation of morphological features of the new species as well as a improved assessment of morphologically similar taxa, I formally validate it in accordance with the current ICN (McNeill et al. 2012). Furthermore, this confirms the number of native *Selaginella* species so far found in Brazil to be 80 and the estimated number in Venezuela to be 100, as indicated in Valdespino (2015).

Selaginella psittacorrhyncha somewhat resembles other centipede-like species, including the Panamanian *S. taylorii* Valdespino and *S. chrysoleuca* Spring and *S. euclimax* Alston ex Crabbe &

Jermy, both from Panama and western South America, but it seems morphologically closer to *S. vernicosa* Baker from Mount Roraima, in the state of Bolivar, Venezuela and the state of Roraima, Brazil, in the Guiana Highlands. This region is known for the high diversity and number of endemic *Selaginella* species (Smith 1990; Valdespino 1992; Smith 1995; Valdespino 2016), thus, it is not surprising that new taxa are uncovered as careful specimen examination proceeds.

The description that follows, including measurements data and terminology used to describe leaves and spores, as well as specimens citation and determination of conservation status, was prepared according to Valdespino (2015, 2016, 2017, and references therein). Herbaria acronyms follow Thiers (2017).

SELAGINELLA PSITTACORRHYNCHA Valdespino**, sp. nov. TYPE: VENEZUELA. Amazonas**. [Depto. Río Negro], Cerro de la Neblina, Río Yatua, 4–8 km SW of Cumbre Camp, 1850–1900 m, 15 Jan 1954, *B. Maguire, J.J. Wurdack, & G.S. Bunting 37298* (holotype: NY; isotype: PMA). Figures 1–4.

Selaginella psittacorrhyncha is morphologically very similar to *S. vernicosa* Baker by its leaf shape but differs noticeably in its ascending to suberect (vs. creeping) habit with the branches ascending (vs. mostly perpendicular to the stem or only slightly ascending), coriaceous (vs. chartaceous) leaves, the lateral leaves on main stem with glabrous (vs. often tufted with 2–6 cilia) basiscopic bases and entire (vs. short-ciliate along proximal ¼–½) basiscopic margins, the median leaves with glabrous or infrequently puberulent only with 1 or 2 short hairs (vs. tufted with 3–5 cilia) outer bases, and distinctly beaked (vs. flat) apices in profile.

Plants terrestrial or epipetric. **Stems** ascending to suberect, stramineous, 6–15 cm long, 0.5–0.7 mm diam., non-articulate, not flagelliform or stoloniferous, 1- or occasionally 2-branched. **Rhizophores** lateral, curving downward as to appear dorsal, borne on proximal ⅕ to ¼ of stems, filiform and stout, 0.1–0.3 mm diam. **Leaves** heteromorphic throughout, coriaceous, strongly imbricate, upper and lower surfaces shiny to waxy and olive colored or on older parts of stems and branches, tawny. **Lateral leaves** imbricate and slightly ascending, ovate-deltate or ovate, 1.8–2.4 × 0.9–1.5 mm; bases truncate, acroscopic bases strongly overlapping stems, basiscopic bases free from stems; acroscopic margins greenish, 1–3 cells wide with the cells elongate, slightly sinuate-walled and glabrous, parallel to margins, shortly-ciliate along proximal ¾ to ⅘, otherwise entire distally, basiscopic margins greenish, comprising quadrangular, sinuate-walled and glabrous cells, entire or infrequently sparsely and minutely ciliate-denticulate; apices obtuse and entire or infrequently tipped by 1 or 3 teeth; upper surfaces comprising quadrangular, slightly sinuate-walled cells (often difficult to distinguish because of waxy deposits), those along the submarginal to marginal side of basiscopic half and on distal ⅓ of the leaves covered by 1 or 2 papillae, without idioblasts or stomata or with some stomata along basiscopic margin, lower surfaces comprising elongate, sinuate-walled cells, with many of those along distal ⅘ of the leaves covered by 1 or 2 papillae, without idioblast, with 6–8 rows of stomata along midrib. **Median leaves** ascending, broadly deltate-ovate, 0.9–1.4 × 0.6–1.2 mm; bases truncate, the outer base glabrous or infrequently puberulent with 1 or 2 short hairs, without auricles; margins greenish, 1–3 cells wide with the cells elongate, slightly sinuate-walled and glabrous, parallel to margins, shortly-ciliate along proximal ⅞, otherwise entire distally; apices acute, prominent and beaked, tipped by an often caducous short cilium or teeth-like projection; both surfaces without conspicuous idioblasts, upper surfaces comprising quadrangular, slightly sinuate-walled cells (often difficult to distinguish because of waxy deposits), those along the submarginal to marginal side of basiscopic half and on distal ⅔ of the leaves covered by 1 or 2 papillae, without idioblasts, with stomata in 3–5 rows along distal ⅔ of the midribs, lower surfaces comprising elongate, sinuate-walled cells, without stomata. **Axillary leaves** ovate to ovate-oblong or similar to lateral leaves, 1.8–2.0 × 1.0–1.3 mm; the bases, margins, apices, and surfaces as in lateral leaves. **Strobili** terminal on main stem and branch tips, quadrangular, 0.4–5.5 cm. **Sporophylls** monomorphic, without a laminar flap,

HOLOTYPE OF:
Selaginella psittacorrhyncha Valdespino sp. nov.
Spichiger, R. Valdespino, 2016 (PMA)
THE NEW YORK BOTANICAL GARDEN VENEZUELAN EXPEDITION 1953-54
Cerro de la Neblina, Río Yatua
Territorio do Amazonas
No. 37298
Selaginella vernicosa Baker
DET: J. T. Mickel & T. Reeves, 1980.
Around rocks in west escarpment savanna 4-8 km. southwest of Cumbre Camp, elev. 1850-1900 m.
Summit. 1700-2000 meters elevation
Bassett Maguire, John J. Wurdack and George S. Bunting
January 15, 1954
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Figure 1. *Selaginella psittacorhyncha*, sp. nov. (*Maguire et al. 37298*, holotype, NY).

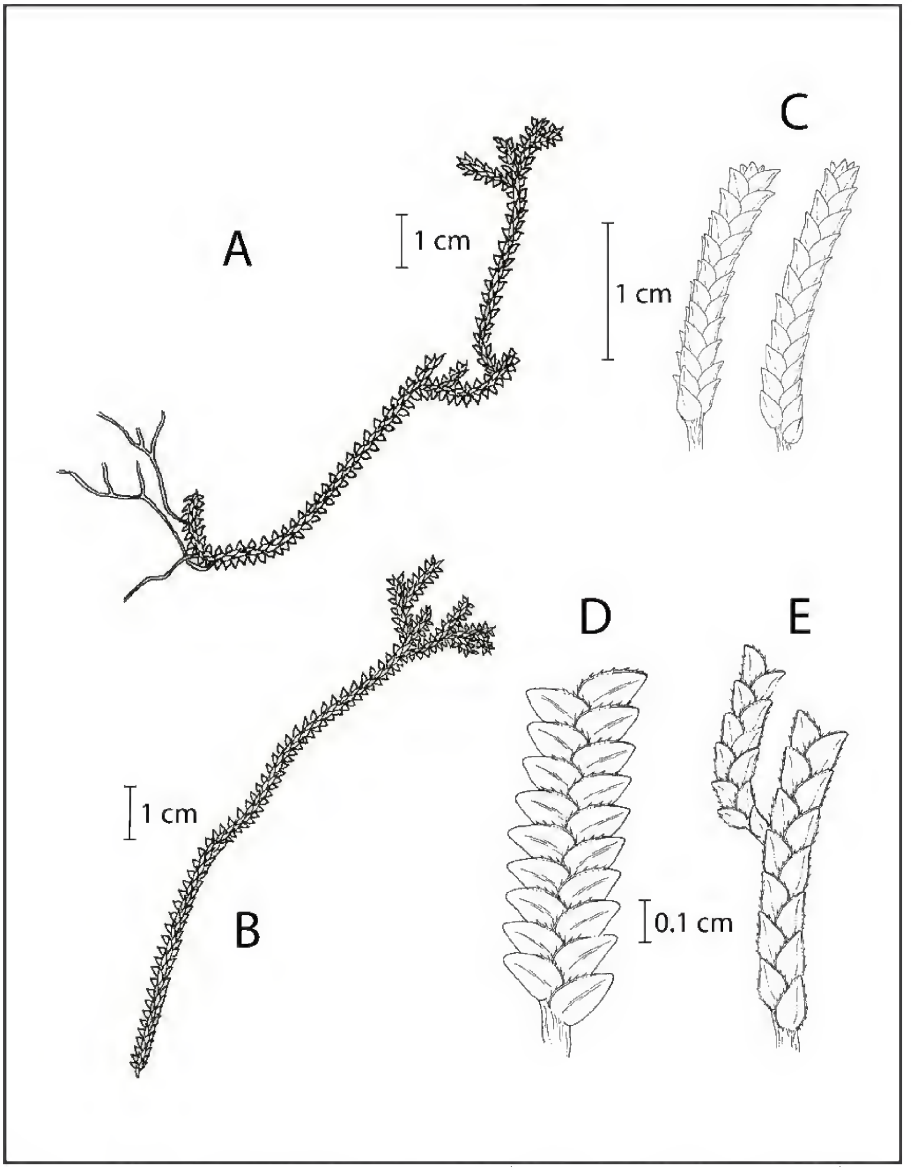

Figure 2. *Selaginella psittacorhyncha* sp. nov. **A**–**B**. (*Maguire et al. 27823,* paratype, NY); **C**–**E** (*Maguire et al. 37298*, holotype, NY). **A**–**B**. Habit. **C**. Strobili. **D**. Close-up of lower surface of stem section showing lateral leaves. **E**. Close-up of upper surface of stem section showing median leaves. Illustration made by Rubén Lozano.

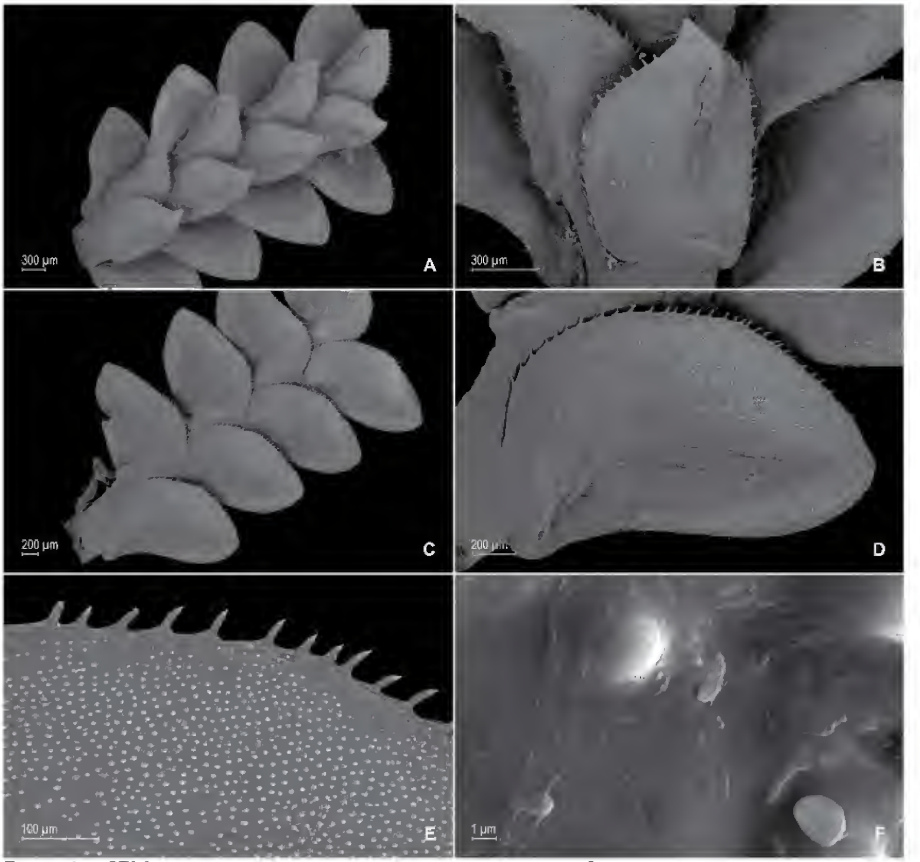

Figure 3. SEM micrographs of branch sections and leaves of *Selaginella psittacorhyncha* sp. nov. (*Maguire et al. 37298*, holotype, NY). **A**. Section of upper surface of stem. **B**. Upper surface of median leaf. **C**. Section of lower surface of stem. **D**. Lower surface of lateral leaf. **E**. Detail section, acroscopic margin of lateral leaf lower surface. **F**. Close-up of lower surface of lateral leaf; note papilla.

each with a strongly developed and seemingly glabrous keel along midribs often ending in a single short cilium or teeth-like projection, broadly ovate to ovate-deltate, 1.5–1.8 × 0.9–1.5 mm; bases rounded to truncate; margins as in median leaves; apices acute to obtuse, often beaked, tipped by 1–3 short cilia or teeth-like projections; **dorsal sporophylls** with upper and lower surfaces as in vegetative leaves; **ventral sporophylls** with both surfaces of the same color as the vegetative leaves, comprising elongate, sinuate-walled cells on both surfaces. **Megasporangia** in 2 ventral rows and often on distal ½ of 2 dorsal rows; **megaspores** deep orange, rugulate-reticulate on proximal faces with verrucate and perforate microstructure, rugulate-reticulate on distal faces with reticula formed by very low muri and granulate and perforate microstructure (Figure 4C & D), 355–375 µm. **Microsporangia** in 2 dorsal rows or only on proximal ½ of 2 dorsal rows; **microspores** deep orange, gemmate on proximal and distal faces with psilate microstructure (Figure 4E & F), 50–58 µm.

Habitat and Distribution. *Selaginella psittacorrhyncha* grows in or around rocky cliffs in montane highland savannas, on wet ledges of cliffs in scrub forests, sandstone outcrops above swampy savanna or on bare earth at base of grass tussocks at 1600–2343 meters; it is documented here in Cerro Sipapo, Venezuela, and Cerro de la Neblina in both Venezuela and Brazil.

Etymology. The specific epithet derives from the Latin "*psittacus,*" meaning parrot, and "*rhynchus,*" nose; together these allude to the median leaf apices resembling a parrot's beak.

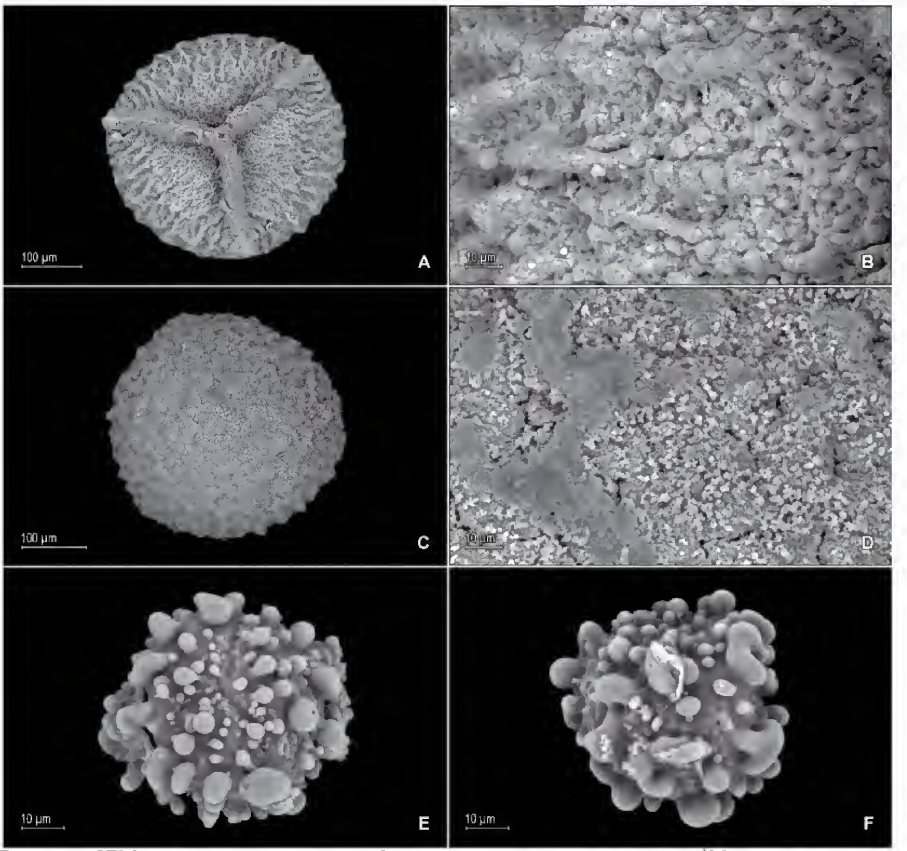

Figure 4. SEM micrographs of spores of *Selaginella psittacorhyncha* sp. nov. (*Maguire et al. 37298*, holotype, NY). **A**. Megaspore, proximal face. **B**. Close-up of megaspore, proximal face. **C**. Megaspore, distal face. **D**. Close-up of megaspore, distal face. **E**. Microspore, proximal face. **F**. Microspore, distal face.

Conservation status. *Selaginella psittacorrhyncha* is here documented in two distinctly isolated tepuis at high elevations in the Amazon basin of Venezuela and Brazil. These areas are difficult to reach by humans and, therefore, the species may not face imminent anthropomorphic-based threats. Accordingly, I tentatively consider it of Least Concern (LC) according to IUCN categories and criteria (2012).

Additional specimens examined (paratypes): **VENEZUELA**. Amazonas. Cerro Sipapo (Paráque), west Peak, 1600 m, 20 Dec 1948, *Maguire & Politi 27823* (NY); [Depto. Río Negro], Cerro de la Neblina, Río Yatua, Cañon Grande basin, 1200–2200 m, 15 Dec 1957, *Maguire et al. 42417* (NY, PMA), Venezuelan-Brazilian Frontier, Neblina Massif, Camp 12, 1950 m, 26–27 Feb 1985, *Boom et al. 6013* (NY, PMA), Cerro de la Neblina, Planicie de Zuluaga, Río Titirico, 2300 m, 10–15 Oct 1970, *Steyermark 103899* (NY), vicinity of Camp VI, on a ridge on Venezuelan-Brazilian border [Cerro de la Neblina], 3.5 km W of Pico Zuloaga, 00°53'N, 65°56'W, 2000 m, 13–15 Apr 1984, *Thomas & Plowman 3145* (NY). **BRAZIL**. Amazonas: São Gabriel da Cachoeira, Parque Nacional do Pico da Neblina, trilha para cachoeira do Anta, Alto da Serra da Neblina, acampamento do Marco 5 da fronteira do Brasil com a Venezuela, 00°48'57"N, 65°58'06"W, 2343 m, 31 Dec 2004, *Carvalho et al. 374* (INPA n.v., PMA).

Selaginella psittacorhyncha is characterized by its centipede-like habit, ascending to erect stems that branch anisotomously once or twice. The secondary branches ascending and striplike or ribbon-shaped, rhizophores borne laterally on stems (a feature that to my knowledge has not been reported before in the genus) that curve downward as to appear dorsal in position, coriaceous leaves, strongly beaked median leaf apices, and orange megaspores. Its overall habit, branching pattern, and strobili position are reminiscent of those found in *S. chrysoleuca*, *S. euclimax*, and *S. taylorii*. Nevertheless, *S. psittacorrhyncha* differs from those species by its lateral rhizophores, coriaceous leaves, acute and parrot's beak-like median leaf apices, and orange megaspores. As previously mentioned, a closer morphological allied species of *S. psittacorrhyncha* is *S. vernicosa* but the former is most distinct by the characters discussed under the diagnosis. In addition, *S. psittacorhyncha* is known from the tepuis of Cerro de la Neblina and Cerro Sipapo, whereas *S. vernicosa* is only known from Mount Roraima in Venezuela and Brazil.

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